Affects of Deep Ripping on Site Index of Lodgepole Pine: 100 Mile House, British Columbia

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INTRODUCTION

Site index is commonly used in British Columbia as a measure of site productivity and forest growth, and it is a valuable tool for managing our forests and estimating timber supply (BC Government 1995; Mah and Nigh 2015).

Deep ripping is a site preparation technique that is used for dry soils, reclaimed mined sites or to break up hard soil layers without mixing soil horizons (Löf et al. 2012).

Figure 1. Winged subsoiler and attachment like what would have been used to deep rip the sample blocks in 1996 (photo credit M. Madill 2020, provided by D. Majcher, e-mail message, Feb. 2, 2021).

Lodgepole pine, or *Pinus contorta,* can produce a higher volume of wood than different species of similar size and it is often favoured for regeneration as it will grow on a wide variety of sites (BC Government 2000).

The sample blocks were located in the 100 Mile House Natural Resource District, south of Flat Lake Provincial Park within the IDFdk3 variant. They were harvested by West Fraser Mills Ltd in 1996, deep ripped in 1998 with a winged subsoiler, and planted with lodgepole pine in 1999.

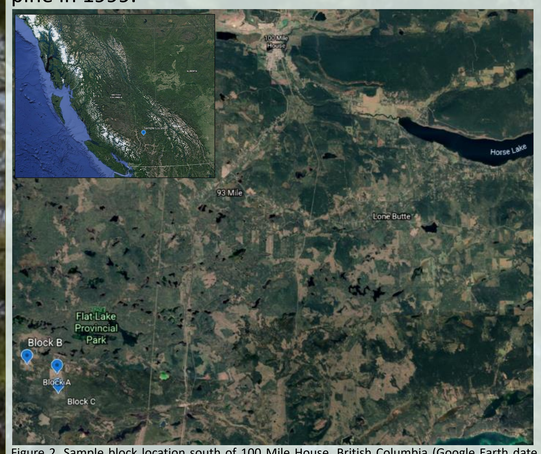

Figure 2. Sample block location south of 100 Mile House, British Columbia (Google Earth date unknown).

METHODS

Plots were systematically laid out on a grid. Trees were selected and sampled following guidelines in the Growth Intercept Method for Silviculture Surveys document (BC Government 1995).

Soil profile and plant communities were used to determine ecological site series using the field guidebook for the region (Steen and Coupé 1997).

Volume and increment growth were compared between the three sample blocks.

Site index for the three blocks was compared between the 2020 date, 2006 information from RESULTS, and the 2013 site index by biogeoclimatic site series (SIBEC) approximation.

RESULTS

Pinegrass (~40%) and kinnikinnick (~15%) were the dominant vegetation in the blocks.

Block C also contained higher amounts of mature and regenerating Douglas–fir trees.

There were almost twice as many regenerating trees/ha than planted in 1999.

Soil in the blocks were silt loams or loams and appeared to be in the soil order Brunisols.

Based on soil properties and the plant community, all three blocks were classified as the IDFdk3/01 FdPl – Pinegrass – Feathermoss site series (Steen and Coupé 1997).

Figure 3. Block A, B and C plant community plots and soil pit.

Block A showed, on average, sample trees with larger diameter and a greater volume per tree.

Block B, on average, had taller trees, with a greater age at breast height and larger site index.

Block C had the lowest of all measured values.

Table 1. Summary statistics for height, age at 1.3m, diameter at breast height (DBH), tree volume and site index in Bs A, B and C (* Government 2013).

Block	Mean Height ± SE (m)	Mean Age at Breast Height ± SE (years)	Mean DBH ± SE (cm)	Mean Volume/tree ± SE (m^3)	Site Index ± SE
A	7.97 ± 0.184	16.60 ± 0.228	11.3 ± 0.3	0.046 ± 0.003	18.60 ± 0.212
B	8.40 ± 0.131	16.93 ± 0.209	10.7 ± 0.2	0.042 ± 0.002	18.97 ± 0.195
C	7.09 ± 0.174	15.93 ± 0.295	9.4 ± 0.3	0.030 ± 0.002	17.50 ± 0.257
SIBEC*	-	-	-	-	19.6 ± 0.7

Volume, diameter at 1.3m, and height in Block C were significantly lower than those in Blocks A and B.

Figure 4. Comparison of average tree volume between Blocks A, B and C.

In Blocks A and B, mean annual increment, or average growth per year, appeared to level out in the last 6 years of growth. Mean annual increment in Block C was still increasing in 2020.

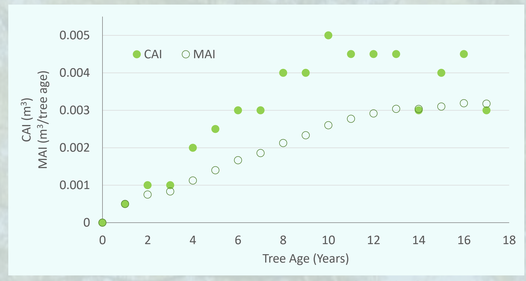

Figure 5. Mean annual increment and current annual increment for Block A from age 0 at 1.3m.

In all three blocks, the site index measured in 2020 did not exceed what was predicted through SIBEC, however it did exceed the site index recorded in 2006.

Block A was close to the standard error for SIBEC and Block B was within the standard error. Block C fell well below what SIBEC predicted for the site.

Figure 6. Comparison of site index from 2020 data, 2006 RESULTS, and predicted by 2013 SIBEC.

CONCLUSION

Overall, the results of this study did not show any benefits of deep ripping to tree growth when compared to SIBEC. However, there are several studies that may help us understand the complex processes that impact growth on forested sites.

Site index is largely impacted by soil moisture and soil nutrients.

The higher proportion of mature Douglas-fir trees in Block C are likely the reason for the significantly lower seedling growth. Mature trees can inhibit growth by competing with younger trees for moisture and nutrients (Teste and Simard 2008).

The depth of the compact/restricting soil layer and the depth of the site preparation will impact the seedlings' response to the disturbance. If the ripping is not deep enough to break up the restricting layer, it may result in increased survival in the short term, but decreased growth over the long-term (Gwaze et al. 2007).

Finally, responses to site preparation can vary greatly depending on grazing, browsing, climatic conditions, sites, and tree species (Löf et al. 2012).

FURTHER RESEARCH

As there has been little research on the impacts of site preparation in BC since the 1980s and 90s, I recommend more studies looking at their impacts while considering SIBEC and climate change.

Looking at blocks that have been site prepared and ones left after harvesting will give us a better understanding on what the treatment changes in the growing conditions.

A wider study looking at other ecological sites could help us understand how these impacts vary across the landscape.

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